DEC STD 140-5 Prototype Release Requirements for Printed-Wiring Boards, Modules, and Backplanes

DOCUMENT IDENTIFIER: A-DS-EL00140-05-0000 Rev B1, 26-Mar-1990

ABSTRACT: This section of DEC STD 140 describes the prototype process and the interface between Engineering and Manufacturing. Successful evaluation of a product design through building and debugging a prototype is a prerequisite for releasing all modules manufactured by Digital.

APPLICABILITY: Mandatory for all 50-class printed-wiring boards, 54-class modules, and 70-class backplanes released by Digital. DEC STD 140-0 provides an introduction and general requirements for this standard.

STATUS: APPROVED 01-Mar-1990; use VTX SMC for current status.

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1 INTRODUCTION

This section of DEC STD 140 describes the prototype process and the interface between Engineering and Manufacturing. Successful evaluation of a product design through building and evaluation of a prototype is a prerequisite for releasing modules manufactured by Digital.

2 RESPONSIBILITIES

The responsible product engineer, as defined by the Chief Engineer's Option/Module List, shall ensure that the assembly plant has all necessary documentation and materials required for prototype build. For backplanes that will be manufactured at Kanata (KAO), the engineer may provide either the part number or the actual part. Contact the New Products Materials Group at Kanata for further information.

3 PROTOTYPE PROCESS OVERVIEW

The prototype fabrication process flow, shown in Figure 1, is intended to provide a limited quantity of circuits for evaluating the design and the producibility of the design prior to releases of 50- and 54-class modules.

3.1 CATEGORIES OF 50-CLASS PROTOTYPES

To maintain flexibility and accommodate prototype design and schedules, three distinct categories of prototype printed-wiring boards are established. They are:

a. Experimental

b. Mechanical fab

c. Pre-release

Prototype PWB fabrication is a service requested by Engineering and performed by the PWB Corporate Procurement Group. Quantity and turnaround times are to be negotiated. Re-orders for the same circuit must also be negotiated.

The boards will be built to the prints. The prototype package will be sent to the requesting design engineer with the printed circuits except for the master artwork which is stored as last pass artwork and may be used during the release cycle. The printed circuits may be drilled, etched, fabricated to circuit size, or any combination of these services may be provided, including optional soldermask, depending on the prototype category. The categories are described in the following subheads.

3.1.1 Experimental

The experimental prototype may be used by the responsible product engineer to test or evaluate any product in the early, conceptual stage of its development. An experimental prototype is intended only for internal use and is not a releasable product. The experimental prototype category includes simulators and printed-wiring boards for circuit evaluation, along with new technology boards that may require special manufacturing considerations.

An experimental board must be assigned a part identifier by the design site. An "EX" must be specified in the class code field of the number followed by a 3-digit site code. The last four digits shall be used for a site-specific numbering scheme; for example, EX-LKG00-00.

3.1.2 Pre-Release

The pre-release prototype category provides Engineering with printed-wiring boards that can be used to evaluate the functional design of a product prior to release. This category represents the typical PWB prototype, which is built in preparation for release. The pre-release prototype must meet all the manufacturing and quality release criteria of all sections of DEC STD 030 Module Manufacturing Standard and *DEC STD 176-0 Printed-Wiring Board Acceptance Criteria,* and other applicable standards.

For all VLS-based design sites, it is recommended that an MRC (Manufacturing Rules Checker) report be included as part of the Producibility check package. Design verification to applicable standards will then be done in parallel to the design by computer checks rather than by visual checks performed at the end of the design process.

3.2 REVISION CONTROL

The PCO Control System defined in *DEC STD 100-0 Policy and Requirements for the Product Change Process* is the recommended procedure for controlling revisions at the prototype level. The responsible product engineer shall specify the following on the workorder:

a. Etch revision

b. Bill of Materials (BOM)

c. Module revision

3.3 ASSEMBLY OF 54-CLASS PROTOTYPES

The 54-class prototype may be assembled in the following ways:

a. Responsible Product Engineer/Technician (usually less than 10 prototypes)

b. The Production Assembly Plant

c. New Products Organization (NPO) Engineering Model Shop

The Engineering Model Shop may receive, *in parallel with* the engineer's evaluation process, pre-release prototype to kit and assemble, if requested on the Printed Circuit Work Request.

This same assembly procedure may occur *after* the engineer's evaluation process, as requested by the Printed Circuit Work Request. See Figure 2 and Figure 3.

The boards and a copy of the UA, KPL, and work request are the items required to assemble the boards. Upon completion of the assembly, it and the prototype-related documentation will be sent to the design site via CSL for coordination with the responsible engineer.

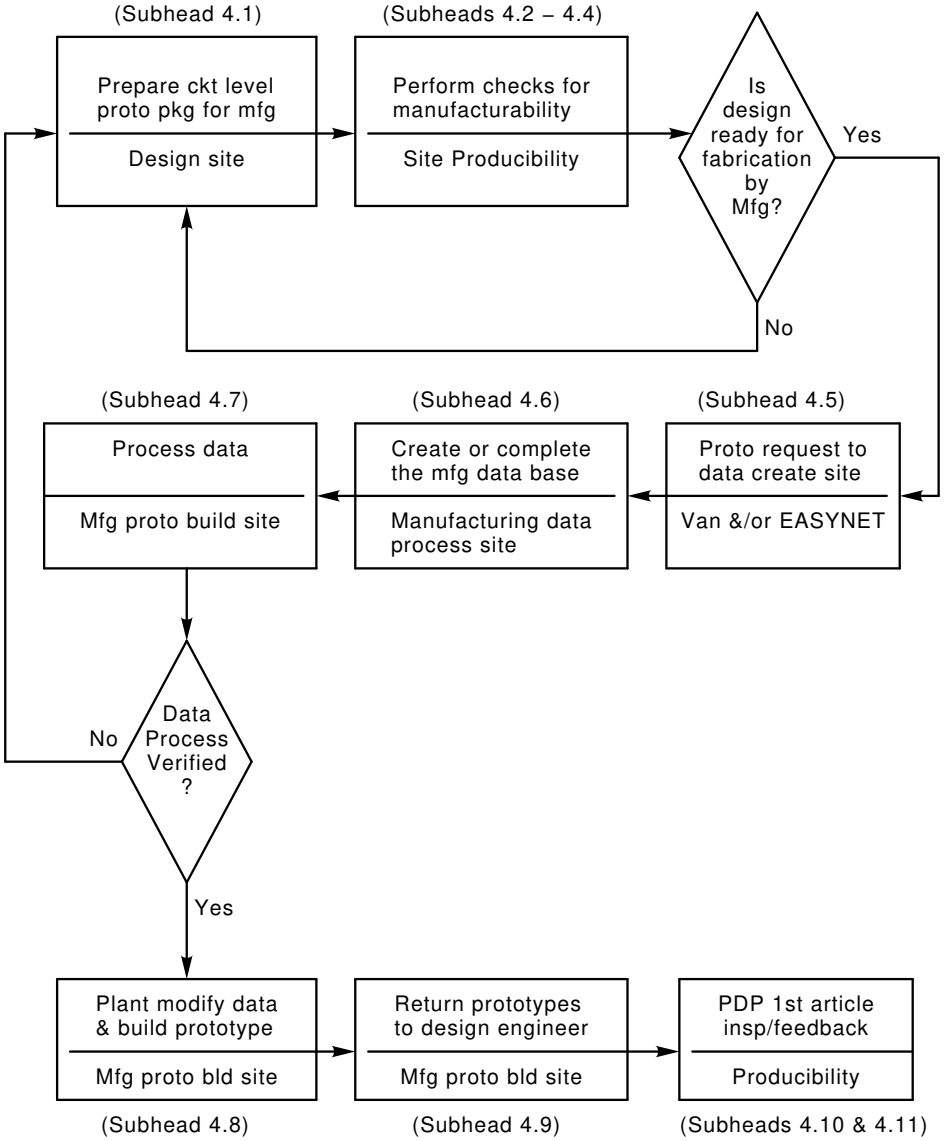
For further information contact:

Bob Snay
MLO5-3/E22, DTN: 223-4606, LUNER::SNAY

4 PROTOTYPE PROCESS DESCRIPTIONS

The prototype process is shown in Figure 1. The subheads under this heading supplement the flowchart annotation shown in Figure 1.

Figure 1: Prototype Fabrication Process Flow



4.1 PROTOTYPE PACKAGE

Once the need for a prototype is determined, the design site will prepare a transfer package of data and information required for producibility checking and manufacturing data generation. This package should be delivered to Producibility for the proper review.

Both the contents of the package and the level of the check will depend of the stage of the product's development at that time. Refer to the Printed Circuit Work Request Form shown in Figure 2 and Figure 3 for requirements.

4.2 SITE PRODUCIBILITY UP-FRONT CHECK

Producibility performs a preliminary check to ensure that the circuit can be built.

a. For experimental prototypes, a minimal producibility check will be performed. This check will be limited to looking for fatal or flagrant manufacturing problems. The feedback sheet will be completed only in those areas that are checked.

   Producibility will provide manufacturing information and a TDF (technical data form) if required. Figure 6 shows a sample TDF. Heading 5 states when a TDF is required.

b. For mechanical fab prototypes, Producibility will check for drill and fabrication information only.

If at this time the design is considered to be not buildable, the transfer package will be returned with appropriate feedback to the design site.

4.3 IN-SERIES CHECK

Site Producibility will perform a complete Producibility Check before the prototype package is sent to the manufacturing data site. If any problems are found that would prohibit the final release of the package, the design is sent back to the design site for correction. The package will be re-checked by Producibility before it is sent to the manufacturing site.

A feedback sheet will be created and shall list any violations to the rules of DEC STD 030, all sections, or the requirements of DEC STD 140. These items must be corrected or waived before the "RELEASE" of the product into production will be allowed. This report is held by Producibility until after the first article inspection is completed and is then forwarded to the design site and the responsible product engineer for appropriate action.

4.4 PARALLEL CHECK

Producibility will perform a complete check in parallel to the board fabrication. If any problems are found that would prohibit the final release of the package, another etch pass or waivers are required before release of the product into production.

A feedback sheet will be created and shall list any violations to the rules of DEC STD 030 or the requirements of DEC STD 140. These items must be corrected or waived before the "release" of the product into production will be allowed. This report is held by Producibility until after the first article inspection is completed and is then forwarded to the design site and the responsible product engineer for appropriate action.

4.5 PROTOTYPE PACKAGE TO DATA CREATION SITE

Once the prototype has been checked by Producibility, the transfer package may be forwarded to the location where the Manufacturing Data will be created. The type of transfer media and actual process used will determine how the data is transferred. Sites using traditional processes will use a shuttle van while sites using one of the "paperless" processes can deliver entirely over the EASYNET.

4.6 CREATE OR COMPLETE THE MANUFACTURING DATA

Once the transfer package is sent to the creation site, assembly- or board-level data will be either created or completed. The actual process will determine the location and procedures of this activity.

For those sites using an automated paperless process, the transfer package will include preliminary data. The data completion site for this process will complete the definition of the data by adding assembly board-level information.

More traditional processes that use PDFs as interface files will be delivered to different sites. Transfer packages for etch boards are typically delivered to the Prototype PWB facility. 54-class prototype transfer packages are typically delivered to the Assembly Group-Level Manufacturing Tool Generation site.

Regardless of the process used, the end result is the same: that is, manufacturing product representatives will take engineering circuit-level information, add manufacturing assembly-level data, and output completed data for the appropriate manufacturing site.

NOTE

Kanata Manufacturing is the Manufacturing Data site for backplanes.

4.7 PROCESS PRODUCT DATA

Because the manufacturing data contains limited process information and is primarily a description of the physical product, it must be processed before manufacturing tools are created. Manufacturing processes and process parameters vary from location to location and are also constantly changing to take advantage of newly developed technologies. For this reason, each manufacturing build site is responsible for integrating their specific process needs with the product data for creating their manufacturing tools.

If data processing cannot be completed, the data package shall be returned to the design site.

4.8 PLANT MODIFY DATA

Once the manufacturing data has been processed, production data such as artwork, drill tapes, and so on, may be created. These tools are used to manufacture the prototype product. All 50-class prototypes (PWBs) are built as required by the Engineering Work Order Request form. See Figure 2, Figure 3, Figure 4, and Figure 5.

For surface mount designs, artwork for solderpaste stencil shall be plotted with the rest of the artwork package and delivered to the engineer or the identified manufacturing prototype build site.

54-Class (assembled module) using the New Products Organization (NPO) - Engineering Model Shop may receive, in parallel with the engineer's evaluation process, prototype PWBs to kit and assemble. If required, this must also be requested on the Engineering Services Printed Circuit Work Request. See Figure 2 and Figure 3. This same module assembly procedure may occur after the engineer's evaluation if requested on the Work Order Request Form. The circuit boards and a copy of the UA, KPL, and the Work Order Request Form are required to assemble the modules.

Upon completion of the assembly, the module, and related documentation will be returned to the design site for coordination with the responsible product engineer.

4.9 RETURN PROTOTYPE TO RESPONSIBLE PRODUCT ENGINEER

The site design services organization will coordinate the receipt of the prototype and delivery to producibility of one PWB for first article inspection.

4.10 SITE PRODUCIBILITY FIRST ARTICLE INSPECTION

A first article inspection should be conducted on all pre-release prototype boards. The feedback sheet for either type of prototype producibility check will be returned to the design organization. The feedback sheet lists all the problems that need to be corrected prior to the next pass prototype of a 50-class, 54-class, or 70-class release.

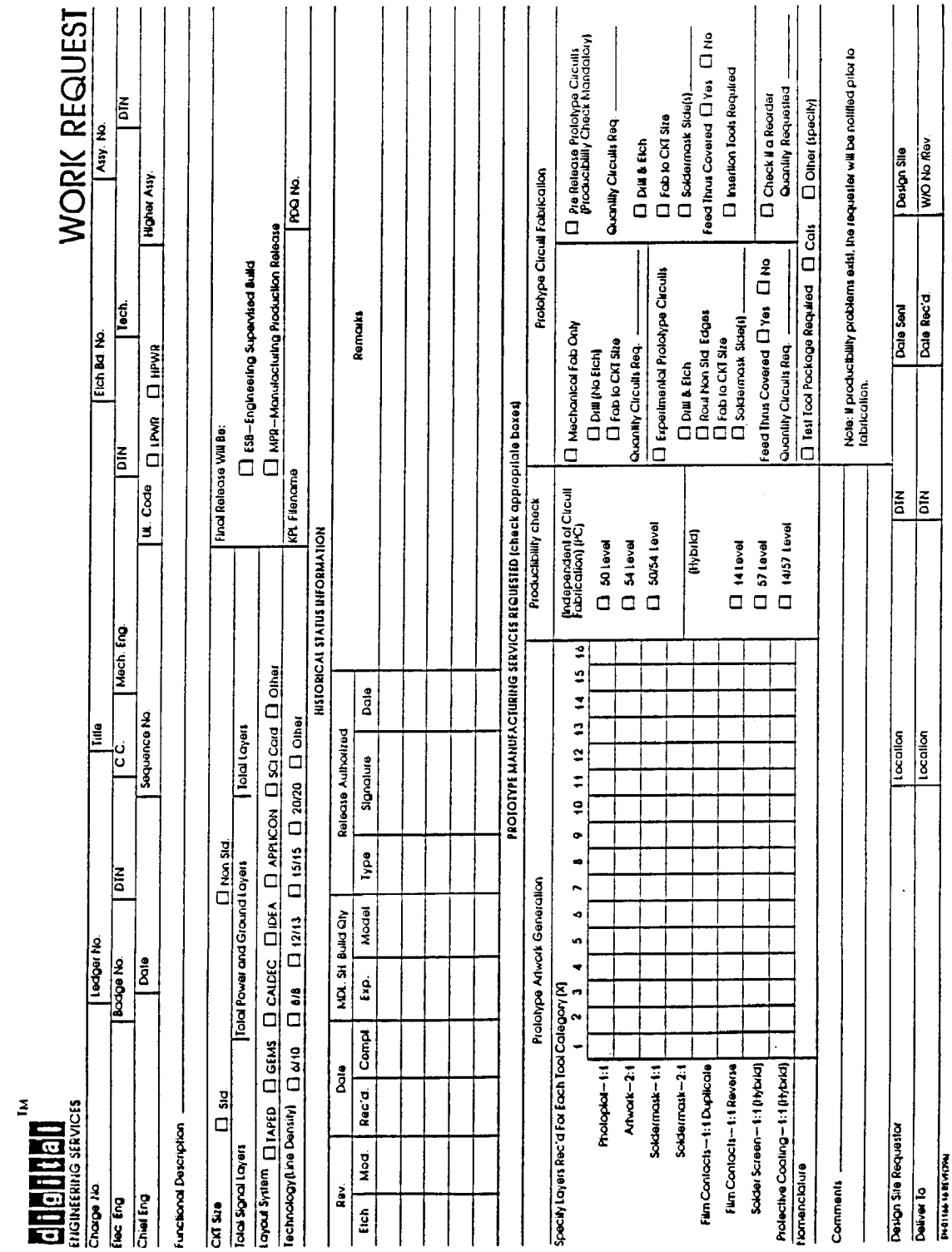
4.11 FEEDBACK RETURN TO RESPONSIBLE PRODUCT ENGINEER

The design site will, upon receipt of the returned package, coordinate with the responsible product engineer to evaluate the impact of the producibility problems indicated on the feedback sheet.

5 PROTOTYPE WORK REQUEST

All Engineering requests for prototype services must be initiated at the design site using the Engineering Services Printed Circuit Work Request. Refer to Figure 2, Figure 3, Figure 4, and Figure 5. The package content for each prototype category is shown on the reverse side of the Printed Circuit Work Request. The information required to build the prototype is listed under "Manufacturing Services Requested".

Figure 2: Engineering Services Printed-Circuit Work Request - Hard Copy (sheet 1 of 2)



digital™ ENGINEERING SERVICES

WORK REQUEST

Charge No. | Ledger No. | Title | Etch Bd No. | Assy. No.

Elec Eng | Badge No. | DIN | C.C. | Mech. Eng. | DIN | Tech. | DIN

Chief Eng | Date | Sequence No. | UL Code ☐ LPWR ☐ HPWR | Higher Assy.

Functional Description

CKT Size ☐ Std ☐ Non Std | Final Release Will Be:

Total Signal Layers | Total Power and Ground Layers | Total Layers ☐ ESB—Engineering Supervised Build

Layout System ☐ TAPED ☐ GEMS ☐ CALDEC ☐ IDEA ☐ APPLICON ☐ SCI Card ☐ Other ☐ MPB—Manufacturing Production Release

Technology(Line Density) ☐ 6/10 ☐ 8/8 ☐ 12/13 ☐ 15/15 ☐ 20/20 ☐ Other | KPL Filename | PDQ No.

HISTORICAL STATUS INFORMATION

Rev. Etch	Rev. Mod.	Date Rec'd.	Date Compl	MDL Sft Build Qty Exp.	MDL Sft Build Qty Model	Release Authorized Type	Release Authorized Signature	Release Authorized Date	Remarks

PROTOTYPE MANUFACTURING SERVICES REQUESTED (check appropriate boxes)

Prototype Artwork Generation

Specify Layers Rec'd For Each Tool Category (X)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Photoplot—1:1																
Artwork—2:1																
Soldermask—1:1																
Soldermask—2:1																
Film Contacts—1:1 Duplicate																
Film Contacts—1:1 Reverse																
Solder Screen—1:1 (Hybrid)																
Protective Coating—1:1 (Hybrid)																

Nomenclature

Producibility check

(Independent of Circuit Fabrication) (PC)

- ☐ 50 Level
- ☐ 54 Level
- ☐ 50/54 Level

(Hybrid)

- ☐ 141 Level
- ☐ 571 Level
- ☐ 1457 Level

Prototype Circuit Fabrication

- ☐ Mechanical Fab Only
  - ☐ Drill (No Etch)
  - ☐ Fab to CKT Size

  Quantity Circuits Req. _____
- ☐ Experimental Prototype Circuits
  - ☐ Drill & Etch
  - ☐ Rout Non Std. Edges
  - ☐ Fab to CKT Size
  - ☐ Soldermask Side(s) _____

  Feed Thrus Covered ☐ Yes ☐ No

  Quantity Circuits Req. _____
- ☐ Test Tool Package Required ☐ Calt ☐ Other (specify)

- ☐ Pre Release Prototype Circuits (Producibility Check Mandatory)

  Quantity Circuits Req. _____
  - ☐ Drill & Etch
  - ☐ Fab to CKT Size
  - ☐ Soldermask Side(s) _____

  Feed Thrus Covered ☐ Yes ☐ No
  - ☐ Insertion Tools Required
- ☐ Check if a Reorder

  Quantity Requested _____

Comments

Note: If producibility problems exist, the requester will be notified prior to fabrication.

Design Site Requestor	Location	DIN	Date Sent	Design Site	
Deliver To	Location	DIN	Date Rec'd	W/O No Rev	

Figure 3: Engineering Services Printed-Circuit Work Request - Hard Copy (Sheet 2 of 2)

	Prototype Service Being Requested					
	Soft Tool Generation Only	50/54 Level Prod.	Mechanical Fab. Only	Soft Tool Generation & Circuit Fabrication		
Applicable Category	Exp & Pre-Rel	Pre-Rel	Fab. Board	Exp	Pre-Rel	Qty of Prints
Engineering Work Req.	Yes	Yes	Yes	Yes	Yes	1
TDF (Copy)	Yes	Yes			Yes	1
Space Check		Yes			Yes	1
PDF	Yes		Yes (2)	Yes	Yes	1
Post Process Sheet	Yes	Yes	Yes (2)	Yes	Yes	1
MD Prints		Yes(1)	Yes(1)	Yes(1)	Yes	3
Varian Plots (or equivalent)		Yes			Yes	1
UA Print(s)		Yes			Yes	2
Parts List Printout		Yes		Yes	Yes	1

NOTE

This is a multi-use form which the DEC STD 140 Committee will publish. The committee is not responsible for its content.

Figure 4: Sample Engineering Services Printed-Circuit Work Request - Electronic (sheet 1 of 2)

```
================================================================================
Digital Equipment Corp   W O R K   R E Q U E S T    FORM: EN-01166-16 NAC5

Engineering Services     PC Design Site:            s/w: PCWORKEDT Vr. 1.2

ASSY. NO:   Etch BD. No:    Highr Assy   PDQ No  CC   Charge    Work Order

--------------------------------------------------------------------------------
Title:                                    Chief Engineer Approval: N

Functional Description:                   Seq:        Date:   -   -

K-PL Filename:

Responsible Parties              Badge   DTN      ENET

Elec. Eng:                                 -

Mech. Eng:                                 -

Technician:                                -

U/L Code:  Lpwr Circuit Size:  Non-std   Signal Layers:nnn  Final Release
Bi Corner: N     Layout System:          Pwr + Ground: nnn  Will Be: Mfg
Surf. Mt:  N     Density Code:  12/12    Total Layers: nnn  Produc.release
Other Technology Information:

================================================================================

History Tracking Of Each Design Pass

--------------------------------------------------------------------------------
Etch  Mod   Date        Date        P.C.
Rev   Rev   Received    Completed   Designer       Comments

================================================================================
                  Prototype Manufacturing Services Requested
--------------------------------------------------------------------------------
Artwork Generation (All 1:1, Unless Specified Otherwise)

-------------------------------1-1-1-1-1-1-1-1-1-1-2-2-2-2-2-2
(Bd Layer)-->1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4

Photoplot    ----------------------------------------------

Soldermask   ----------------------------------------------

Solderpaste  ----------------------------------------------

Film (Dup.s) ----------------------------------------------

Film,reverse ----------------------------------------------

(Option line)---------------------------------------------

(Option line)---------------------------------------------

Nomenclature:    X/X
```

Figure 5: Sample Engineering Services Printed-Circuit Work Request - Electronic (sheet 2 of 2)

```
================================================================================
                              CIRCUIT FABRICATION
--------------------------------------------------------------------------------

Reorder: N   Quantity:
Mechanical Fab: N   Pre-Released Prototye: N  Experimental Prototype: N

Drill & Etch: N  Drill Only: N   Fab to CKT Size: N  Soldermask: N
Feed Thrus Covered: N   Insertion Tools Required: N
Test Tool Package:

--------------------------------------------------------------------------------
Requestor:        Location:    DTN:        ENET:               Date: - -

Deliver To:

--------------------------------------------------------------------------------
                             ADDITIONAL COMMENTS:









--------------------------------------------------------------------------------
```

6 TECHNICAL DATA FORM (TDF)

Figure 6 shows a sample Technical Data Form (TDF) from the CAMPA database.

Figure 6: Technical Data Form

```
********* F O R  D I G I T A L  I N T E R N A L  U S E  O N L Y **********
              TDF (Part I) - PDQ #:        Rev    Date
--------------------------------------------------------------------------------
         Technician:                              Date

    Up Front check:      Pre-release check:     50-Release:       54-Release:

         *Status:              Board ID:                *Mod REV:
                               Etch Rev:                Module ID:
     Board Width:           Board Height:               Module ID:

   Circuit Width:          Circuit Height:             Module ID:

   Step & Repeat:            Line Density:             Module ID:

          Layers:         Technology Defn:             Module ID:

         Fingers:         Soldermask Side:

     *Layout Sys:       Feedthrus Covered:

     *Ins_Waiver:                Waiver:

 Cont. Impedance:        Std AutoThieving:

 *Testhead tools:      Surface Mount Side:

 * - Not required at Prototype


   ENGINEERING SPECIAL FEATURES/INFORMATION:

   (L  ):
   (L  ):
   (DRL):
   (CIW):
   (LDN):

 ADDITIONAL INFORMATION: (Include Autothieving voids, if applicable)
```

APPENDIX A REFERENCED DOCUMENTS

A.1 EL-Class Digital Documents

EL-Class Number	Document Title
EL-00030-00	*DEC STD 030-0 Module Manufacturing Standard - Introduction and General Information*
EL-00100-00	*DEC STD 100-0 Policy and Requirements for the Product Change Process*
EL-00176-00	*DEC STD 176-0 Printed-Wiring Board Acceptance Criteria*

Use VTX SMC to order copies of EL-class documents from Standards and Methods Control. Send distribution questions to JOKUR::SMC or call DTN: 234-4423.

```
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————————**FOLD ON THIS LINE**———————————————— -

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